What is claimed is:

1. A wire comprising a core wire of a carbon nanotube structure in which functional groups bonded to plural carbon nanotubes are chemically bonded and mutually cross-linked to configure a mesh structure.

2. A wire according to claim 1, wherein the carbon nanotube structure is produced by curing a liquid solution containing plural carbon nanotubes to which functional groups are bonded, and by chemically bonding together the plural functional groups bonded to the carbon nanotubes to form a cross-linked site.

3. A wire according to claim 2, wherein:

each of the cross-linked sites has a structure, in which the plural functional groups are cross-linked together through a cross-linking agent in the liquid solution; and

the cross-linking agent is a not self-polymerizable cross-linking agent.

4. A wire according to claim 1, wherein each of the cross-linked sites, where the plural carbon nanotubes are cross-linked to one another, has at least one chemical structure selected from the group consisting of $-COO(CH_2)_2OCO-$, $-COOCH_2CHOHCH_2OCO-$, $-COOCH_2CH(OCO-)CH_2OH$, and $-COOCH_2CH(OCO-)CH_2OCO$.

5. A wire according to claim 2, wherein the cross-linked sites are formed through chemical bonds of the plural functional groups.

6. A wire according to claim 5, wherein a reaction forming the chemical bonds is at least one reaction selected from the group consisting of a dehydration condensation, a substitution reaction, an addition reaction, and an oxidative reaction.

7. A wire according to claim 1, wherein each of the cross-linked sites, where the plural carbon nanotubes are cross-linked to one another, has at least one chemical structure selected from the group consisting of -COOCO-, -O-, -NHCO-, -COO-, -NCH-, -NH-, -S-, -O-, -NHCOO-, and -S-S-.

8. A wire according to claim 1, wherein the plural carbon nanotubes are multi-wall carbon nanotubes.

9. A wire according to claim 1, further comprising a coating arranged on a periphery of the core wire of the carbon nanotube structure.

10. A method of manufacturing a wire, comprising:

applying a base body surface with a liquid solution containing plural carbon nanotubes that have plural functional groups bonded thereto; and

cross-linking the plural carbon nanotubes to one another through chemical bonding the plural functional groups together to form a core wire layer of a carbon nanotube structure to configure a mesh structure.

11. A method of manufacturing a wire according to claim 10, wherein the liquid solution includes a cross-linking agent that cross-links the plural functional groups together, and wherein the cross-linking agent is a not self-polymerizable cross-linking agent.

12. A method of manufacturing a wire according to claim 11, wherein:

each of the functional groups is at least one functional group selected from the group consisting of -OH, -COOH, -COOR (R is a substituted or unsubstituted hydrocarbon group), -COX (X is a halogen atom), $-NH_2$, and -NCO; and

the cross-linking agent is capable of prompting a cross-linking reaction with the selected functional groups.

13. A method of manufacturing a wire according to claim 11, wherein:

the cross-linking agent is at least one cross-linking agent selected from the group consisting of polyol, polyamine, polycarboxylic acid, polycarboxylate, polycarboxylic acid halide, polycarbodiimide, and polyisocyanate; and

the functional groups are capable of prompting a cross-linking reaction with the selected cross-linking agent.

14. A method of manufacturing a wire according to claim 11, wherein:

each of the functional groups is at least one functional group selected from the group consisting of -OH, -COOH, -COOR (R is a substituted or unsubstituted hydrocarbon group), -COX (X is a halogen atom), $-NH_2$, and -NCO;

the cross-linking agent is at least one cross-linking agent selected from the group consisting of polyol, polyamine, polycarboxylic acid, polycarboxylate, polycarboxylic acid halide, polycarbodiimide, and polyisocyanate; and

the functional groups and the cross-linking agents are respectively selected for a combination capable of prompting a cross-linking reaction with one another.

15. A method of manufacturing a wire according to claim 12, wherein each of the functional group is -COOR (R is a substituted or unsubstituted hydrocarbon group).

16. A method of manufacturing a wire according to claim 15, wherein the cross-linking agent is polyol.

17. A method of manufacturing a wire according to claim 15, wherein the cross-linking agent is glycerin and/or ethylene glycol.

18. A method of manufacturing a wire according to claim 10, wherein the liquid solution further includes a solvent.

19. A method of manufacturing a wire according to claim 18, wherein the cross-linking agent also functions as a solvent.

20. A method of manufacturing a wire according to claim 10, wherein a

reaction forming the chemical bonds is a reaction for chemical bonding the plural functional groups together.

21. A method of manufacturing a wire according to claim 20, wherein the liquid solution further includes an additive that forms the chemical bonds among the functional groups.

22. A method of manufacturing a wire according to claim 21, wherein the reaction is a dehydration condensation and the additive is a condensing agent.

23. A method of manufacturing a wire according to claim 22, wherein each of the functional groups is at least one functional group selected from the group consisting of -COOR (R is a substituted or unsubstituted hydrocarbon group), -COOH, -COX (X is a halogen atom), -OH, -CHO-, and $-NH_2$.

24. A method of manufacturing a wire according to claim 23, wherein each of the functional groups is -COOH.

25. A method of manufacturing a wire according to claim 22, wherein the condensing agent is at least one condensing agent selected from the group consisting of sulfuric acid, N-ethyl-N'-(3-dimethylaminopropyl)carbodiimide, and dicyclohexyl carbodiimide.

26. A method of manufacturing a wire according to claim 21, wherein the

reaction is a substitution reaction and the additive is a base.

27. A method of manufacturing a wire according to claim 26, wherein each of the functional groups is at least one functional group selected from the group consisting of $-NH_2$, -X (X is a halogen atom), -SH, -OH, $-OSO_2CH_3$, and $-OSO_2(C_6H_4)CH_3$.

28. A method of manufacturing a wire according to claim 26, wherein the base is at least one base selected from the group consisting of sodium hydroxide, potassium hydroxide, pyridine, and sodium ethoxide.

29. A method of manufacturing a wire according to claim 20, wherein the reaction is an addition reaction.

30. A method of manufacturing a wire according to claim 29, wherein each of the functional groups is -OH and/or -NCO.

31. A method of manufacturing a wire according to claim 20, wherein the reaction is an oxidative reaction.

32. A method of manufacturing a wire according to claim 31, wherein each of the functional groups is -SH.

33. A method of manufacturing a wire according to claim 31, wherein the

liquid solution further includes an oxidative reaction accelerator.

34. A method of manufacturing a wire according to claim 33, wherein the oxidative reaction accelerator is iodine.

35. An electromagnet constructed by winding the wire according to claim 1 in a coil shape.